

during which said start bit of said valid ranging ID sequence was found and broadcasting a confirmation message that indicates a valid ranging ID sequence was found during a particular frame number and giving the valid ranging ID sequence(s) found along with the frame number during which arrived the start bit of each valid ranging ID sequence found and a number of chip times said start bit was offset from a reference time in said gap during which said start bit arrived;

L) in said remote unit modem, calculating an offset from data received in messages from said central unit modem and using said offset to adjust said delay value to achieve precise frame synchronization in this boundless ranging process.

REMARKS

Claim 84 was rejected under 35 USC 112 for indefiniteness fore reciting "any ranging circuit". In response to this rejection, claim 84 has been amended as follows (only the italicized changes were made in response to the rejection):

a conventional time division multiplexed transmitter coupled to receive upstream payload data and said local clock and local carrier signals and organize said payload data into timeslots and transmit said timeslots, but said transmitter having an improvement comprising ~~any type ranging circuitry~~ a ranging circuit that carries out a ranging protocol ~~cooperates~~ with a central transceiver to determine a transmit frame timing delay which, when imposed by said time division multiplexed transmitter prior to transmission of each upstream frame, will cause frame synchronization to exist such that each upstream frame ~~frames~~ transmitted by said remote transceiver arrives at said central transceiver timed so as to have its timeslot boundaries exactly lined up in time with the timeslot boundaries of upstream frames transmitted by other remote transceivers that have already achieved frame synchronization.

The "ranging circuit" limitation is to be interpreted as any one of the multiple embodiments of ranging circuits disclosed in the specification and not every possible ranging circuit. The remaining changes were made voluntarily to clarify that the

86 ranging circuit carries out a ranging protocol with the central transceiver to determine
87 a transmit frame timing delay value for this particular remote unit transmitter which,
88 when imposed prior to transmission of each upstream frame from this remote unit
89 transmitter, will cause each upstream frame to arrive at the central unit transmitter
90 with its frame boundaries aligned in time with frame boundaries of other upstream
91 frames transmitted from a different remote unit transmitter at a different distance away
92 from said central unit transmitter. The phrase "any conventional clock and carrier
93 recovery circuits" was voluntarily shortened to just "clock and carrier recovery
94 circuits".

95 The limitation "conventional" at line 11 was also removed voluntarily as that
96 term is open to interpretation and might be considered vague by some.

97 Claim 85 was rejected as indefinite for reciting limitations in terms of intended
98 results rather than positive structural limitations. The undersigned is not certain
99 which limitations the Examiner was referring to, but amended claim 85 as follows in
100 response to the rejection:

101 The apparatus of claim 84 wherein said central transceiver sends downstream
102 frames to each remote transceiver and is structured to use any modulation
103 scheme and a time division multiple access multiplexing scheme to transmit a
104 master clock reference and master carrier references as well as payload data to
105 said remote transceivers multiplexed in any way including no multiplexing and
106 modulated in any way, and wherein said synchronous time division multiplexed
107 transmitter generates upstream frames of the same size as said downstream
108 frames and said ranging circuitry is structured to establish said transmit frame
109 timing delay such that upstream frames transmitted by said remote unit modem
110 have their frame boundaries aligned in time not only with the frame boundaries
111 of other remote transceivers which have achieved frame synchronization but also
112 correctly aligned in time with frame boundaries established by an upstream
113 frame counter in said central transceiver.

The purpose of these amendments was to remove the "any multiplexing" limitation from claim 85 since the central transceiver has to transmit downstream using time division multiple access multiplexing since the parent claim 84 specifies that the remote unit receivers are time division multiple access receivers. Any modulation scheme can still be used by the central transceiver, and this is supported by the following passage from the specification at page 144, line 7:

The CU modem transmits data in the downstream direction toward the RU modems using a transmitter 1170 that uses digital data to modulate one or more radio frequency carriers that are transmitted over the media 1162 after frequency conversion by up/down frequency converter 1174 to the proper assigned downstream channel frequency. The transmitter can use any modulation and any multiplexing scheme which can effectively transmit a master clock reference and a master carrier reference signal as well as payload data to the RU modems. The clock and carrier references may be transmitted either in-band or out-of-band. Data is transmitted in frames which the RU receiver detects. The RU transmitter achieves frame synchronization by the ranging processes described elsewhere herein or by any other means. Examples of multiplexing schemes that will work for the downstream direction CU transmitter are TDMA, synchronous TDMA, FDMA, Inverse Fourier, SCDMA or DMT (digital multitone transmitter). Any compatible modulation scheme can be used. Any of the conventional transmitters described in the treatises incorporated by reference herein will suffice for the CU transmitter, but an SCDMA transmitter is preferred. Non-SCDMA multiplexing schemes can be used in the downstream direction because the noise and interference problems are less severe than in the upstream direction.

Claim 87 was rejected for indefiniteness for reciting a relative term "good correlation properties". In response to this rejection, the limitation "with good correlation properties such that it can be found in the presence of noise" has been removed from the claim.

Claim 88 was rejected for indefiniteness for using the phrase "that can be found in the presence of noise". In response to this rejection, the phrase "that can be found in the presence of noise," has been removed from the claim. Some voluntary changes were made at line 12 to eliminate a redundant phrase.

Claim 90 was rejected as indefinite for using the phrase "any multiplexing and nay modulation". In response to this rejection, the claim was amended as follows:

a downstream transmitter means for using time division multiple access, synchronous time division multiple access, frequency division multiple access, inverse Fourier, synchronous code division multiple access or digital multitone ~~any~~ multiplexing and a ~~any~~ modulation technique compatible with said remote transceivers to transmit data from different services downstream to said plurality of remote transceivers;

Support for these changes is found in the following passage from the specification at page 140:

The CU modem transmits data in the downstream direction toward the RU modems using a transmitter 1170 that uses digital data to modulate one or more radio frequency carriers that are transmitted over the media 1162 after frequency conversion by up/down frequency converter 1174 to the proper assigned downstream channel frequency. **The transmitter can use any modulation and any multiplexing scheme which can effectively transmit a master clock reference and a master carrier reference signal as well as payload data to the RU modems.** The clock and carrier

references may be transmitted either in-band or out-of-band. Data is transmitted in frames which the RU receiver detects. The RU transmitter achieves frame synchronization by the ranging processes described elsewhere herein or by any other means. Examples of multiplexing schemes that will work for the downstream direction CU transmitter are TDMA, synchronous TDMA, FDMA, Inverse Fourier, SCDMA or DMT (digital multitone transmitter). Any compatible modulation scheme can be used. Any of the conventional transmitters described in the treatises incorporated by reference herein will suffice for the CU transmitter, but an SCDMA transmitter is preferred. Non-SCDMA multiplexing schemes can be used in the downstream direction because the noise and interference problems are less severe than in the upstream direction. (emphasis added)

Another change was made at line 10 of claim 90 to remove the "of any design" limitation describing the receiver means since this means must be interpreted in accordance with 35 USC 112, para. 6 to cover the teachings in the specification and equivalents.

Another change was made at lines 14 and 15 of the claim in response to the indefiniteness rejection to remove the limitation "can use" and substitute language to the effect that the messages sent from the central transceiver to the remote transceivers are part of a predetermined protocol designed to achieve frame synchronization.

Claim 93 was rejected as indefinite for inclusion of the phrases "will cause" and "anything". In response to this rejection, claim 93 was amended as follows:

iteratively transmitting a ranging signal, and determining a transmit frame timing delay value for said ranging signal ~~that will cause which, when imposed for transmission of said ranging signal, causes said ranging signal to~~ arrive at a reference time in a gap in upstream transmissions during which no remote transceiver is allowed to transmit upstream payload data ~~anything other than ranging signals,~~

These changes recite positive steps and do not use the future tense and should not be considered to be indefinite.

Claim 95 was rejected as indefinite for inclusion of the limitations "which can be detected" and "in any way". In response to these rejections, these limitations have been removed from the claim.

Claim 96 was rejected for indefiniteness for inclusion of the limitations, "capable of receiving all the carrier waves and recovering the digital upstream data from each source". In response, this limitation was removed from the claim.

A new claim 97 has been added to cover a ranging embodiment disclosed in the specification starting at page 168, line 18 to page 171, line 24. New claims 98 through 101 cover various boundless ranging embodiments disclosed starting at page 171 and

continuing on for several pages in the specification. What is different about the boundless ranging embodiments from the ranging embodiments previously claimed is the use of a start bit to resolve ambiguity about the time of arrival of a valid ranging ID and the ability to listen to multiple chip times in a window in the middle of the gap to allow multiple remote units to range simultaneously and receive frame numbers of the frame in which their start bits were found in a particular chip time and use those frame numbers to calculate offsets to their transmit frame timing delays to achieve precise frame synchronization.

Claims 84 through 90 were rejected as obvious over Bustamante (US 5,548,583 -hereafter Bustamante 1). Bustamante discloses an enhanced 911 system for cell phones to calculate cell phone positions using triangulation equations based upon time of arrival data of a transmission from a cell phone to three different cell base stations.

In response to this rejection, claim 84 has been amended to add the following new limitation:

a ~~conventional~~ time division multiplexed transmitter, coupled to receive upstream payload data and said local clock and local carrier signals and including a circuit to organize said payload data into timeslots with preamble data known to said central transceiver inserted into at least some of said timeslots so as to cause said preamble data to be received by said central transceiver preceding reception of any payload data when data in said timeslots is transmitted, and said transmitter including circuitry to transmit said payload data and preamble data in said timeslots,

What distinguishes this TDMA system from TDMA systems in the prior art and the OCDMA system of Bustamante 1 is the use of the preamble data plus use of the master clock to synchronize local clocks in the remote unit upstream transmitters. The local clocks are used by the transmitters in the remote units to transmit to the central transceiver and preamble data is inserted before the payload data in each remote unit. Since all the local clocks of the remote units are synchronized to the same master clock at the central transceiver, this means that all remote transmitters transmit on the same frequency. Therefore, only phase differences and amplitude differences resulting from

the different distances of the remote transceivers from the central transceiver need to be compensated for at the central transceiver in order to receive each remote transceiver's transmission. Determining these phase and amplitude differences is what the preamble data is used for. The central transceiver does not need a phase locked loop for each remote transceiver to lock onto its frequency and it does not need to share a single phase locked loop to receive the timeslots transmitted by each remote transceiver. The central transceiver can simply use its master clock as a frequency reference to receive each remote transceiver's transmissions and can use the known preamble data in each transmission to calculate a phase and amplitude offset for each remote transceiver. This makes a more reliable and less expensive central unit transceiver by cutting down on the amount of circuitry needed. Further, PLLs that need to stay locked to multiple remote transmitters will eventually lose lock and cause communication failures.

Bustamante 1 is not directed to this same problem, and, as a result, does not teach the circuitry needed to solve this problem or render the amended claim 84 obvious. The problem addressed by Bustamante 1 is how to accurately determine the time of arrival of a ranging signal transmitted from a cell phone in three different base stations so that a triangulation calculation as to the position of the cell phone can be made. The fact that Bustamante 1 does not teach a handset which synchronizes its local transmit clock to the base station master clock and does not send preamble data for use in deriving phase and amplitude differences for each handset can be concluded from the following passage from Col. 9, lines 52-56. There, it is stated in the handset synchronization section:

The base station order wire channel performs a delay lock loop error measurement on this signal, and prepares and queues a timing correction command, if required to be sent to that handset at the next opportunity.

This pertains to the ranging signals transmitted by the handsets to get synchronized and minimize interference for any particular handset that has completed ranging from other handsets transmitting at the wrong times. This passage suggests no preamble data inserted before payload data and suggests the use in the base station of a PLL to lock onto the handset ranging signal. This teaches away from the use of the master clock and preamble data instead of a PLL to lock onto each remote transmitter's signals.

PATENT

Claims 85 through 89 are dependent from claim 84, so these claims are not obvious for the same reason claim 84 is not obvious.

Claim 90 was rejected as obvious over Bustamante (US 5,548,583 -hereafter Bustamante 1). Claim 90 claims the central upstream transceiver's receiver in means plus function language which must be interpreted in accordance with the teachings of the specification and equivalents thereof. As such, this element would include the circuitry disclosed in the specification to use the master clock and preamble data to receive each remote transmitter's transmissions. However, to make sure that this means plus function clause is interpreted in this manner, the element was amended as follows to specify as part of the functional statement that the master clock and preamble data are used to determine phase and amplitude offsets for each remote transmitter and to receive that transmitter's upstream transmissions.

an upstream TDMA or SCDMA receiver means ~~of any design for using a~~
master clock in said synchronous multiplexed central transceiver and known
preamble data transmitted by each said remote transceiver prior to transmission
of any upstream payload data to determine phase and amplitude offsets for each
remote transceiver's upstream ~~receiving~~ time division multiplexed or
synchronous code division multiplexed transmissions ~~from all of said remote~~
~~transceivers;~~

Accordingly, claim 90 is not obvious for the same reasons claim 84, as amended, is not obvious.

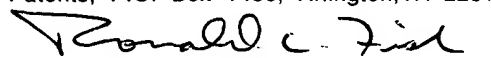
Respectfully submitted,

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